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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/584,301	08/07/2007	Henrik Jensen	55320.000-402	9824
21967 7590 05/13/2009 HUNTON & WILLIAMS LLP INTELLECTUAL PROPERTY DEPARTMENT 1900 K STREET, N.W. SUITE 1200 WASHINGTON, DC 20006-1109			EXAMINER HAN, SHENG	
			ART UNIT 1793	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/584,301

Applicant(s)

JENSEN ET AL.

Examiner

SHENG HAN

Art Unit

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1, 6, 7, 9, 11, 13, 15, 17, 18, 24, 25, 29, 30, 32, 39, 43, 51, 52, 58, 60, 92, 93, 97, 98, 103, 112 and 114 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: ____.

Continuation of Disposition of Claims: Claims pending in the application are
1,6,7,9,11,13,15,17,18,24,25,29,30,32,39,43,51,52,58,60,92,93,97,98,103,112 and 114.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 24, 29 and 103 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claim 1, "other such compounds" is not clear as to what is included in this limitation.

Regarding Claim 24, the temperature description "performed at a temperature profile being an arbitrary combination at least two of the temperature profiles: a fixed temperature, an increasing temperature, a decreasing temperature" is confusing and unclear as to what exactly the temperature is. Additionally, it is further unclear as to whether these are two temperatures for one composition, two temperatures of more than one composition, two temperature for parts of a compositions or whether Applicant simply means to say that the temperature is arbitrary.

Regarding Claim 29, the pressure description stating that the pressure is performed at a "pressure profile being an arbitrary combination at least two of the pressure profiles: a fixed pressure, an increasing pressure, a decreasing pressure" is unclear as to what is meant. Additionally, it is further unclear as to whether these are

two pressures for one composition, two pressures of more than one composition, two pressures for parts of a compositions or whether Applicant simply means to say that the pressure is arbitrary.

Regarding Claim 103, it is not clear if the claim is limited to the compounds following "such as."

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

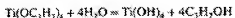
A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claim 1 is rejected under 35 U.S.C. 102(a) as being anticipated by Reverchon et al. ("Synthesis of Titanium Hydroxide nanoparticles in Supercritical Carbon Dioxide on the Pilot Scale").

Reverchon discloses several methods of producing titanium hydroxide (Ti(OH)₄) and titanium oxide (TiO₂) by using known sol-gel preparation methods and modifications thereof (introduction). One of these methods discussed by Reverchon is taught by Tadros, which uses a hydrolysis method of a titanium-precursor (titanium tetra-isopropoxide (TTIP)) by mixing TTIP with water, a surfactant and supercritical carbon dioxide (SC-CO₂) to form Ti(OH)₄ microparticles with a particle size distribution of between 0.1 to 2.0 microns (pg. 254, col. 1, para. 2). Another similar process

described by Reverchon uses the same compounds in different order and at different pressure and temperatures (30 MPa at 50 degrees Celsius, pg. 254, col. 1, para. 2). In general, Reverchon describes the process as following the general order of the following formula:



In the specific invention described by Reverchon, the author teaches the formation of $\text{Ti}(\text{OH})_4$ using various starting materials including CO_2 , CO_2 -TTIP and CO_2 - H_2O and a liquid separator (pg. 254, sec. 2). Here, TTIP serves as the semi-metal containing precursor and water is the co-solvent (pg. 254, sec. 2, para. 3). A supercritical solvent comprising carbon dioxide is used in the reaction (pg. 254, section 2, para. 3, SC- CO_2). CO_2 - H_2O is also used, and can function as either the reactant, or the solid reactor filling material, or both (pg. 254, section 2, para. 3). Finally, a liquid separator (pg. 254, section 2, para. 1, "LS") and silica gel (pg. 254, section 2, para. 4) are both added to this reaction and can function as one of the reaction starting materials. Since TTIP (the semi-metal) is mixed with H_2O , they are inherently in contact with each other. Finally, the process results in the formation of $\text{Ti}(\text{OH})_4$ (page 254, section 2, para. 1).

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Merzbacher (6296678).

Merzbacher discusses a method of making metal powders (col. 1, lines 21-25) that are ultra-fine in size (col. 3, lines 1-2) using a modified sol-gel reaction (col. 2, lines

3-5). In one example disclosed by Merzbacher, a silica compound was prepared by mixing a silica-based precursor (tetramethoxysilane, col. 6, lines 29-30) with anhydrous methyl alcohol (col. 6, line 30), water ammonium hydroxide (col. 6, line 31) and water (col. 6, line 31). Since all these compounds were mixed together, the semi-metal and the co-solvent come into contact with each other. Supercritical CO₂ was used to dry the composition (col. 6, lines 44-45).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 6, 7, 9, 11, 17, 18, 25, 30, 32, 39, 43, 51, 52, 92, 93, 97, 98 and 103 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tillotson (2004/0060626).

Tillotson instructs on a method of making a metal oxide material using a modified sol-gel process (abstract and para. 0026). In one process, Tillotson teaches using a metal salt reduction process route (para. 0032), a metal alkoxide precursor route (para. 0034), or the process whereby other solvents are used with water (para. 0037). According to Tillotson, one method of making the metal oxide is to dissolve a metal salt or metal alkoxide in a solvent to form a metal salt solution or a metal alkoxide solution (claim 1). Tillotson teaches that one can optionally add a proton scavenger to the solution (claim 1), which can be a hydrocarbon-based compound or an alcohol (para. 0032).

Afterwards, a fuel source is added to the mixture (Claim 1), such as a particulate metal (para. 0058). This composition can also comprise polymers (para. 0063). Since the metal salt or metal alkoxide is in a solvent, it is therefore also in contact with the solvent. This mixture is then followed by a supercritical extraction (claim 5) wherein the compound can be carbon dioxide (para. 0020). Furthermore, this reaction is made in a

series of beakers which can be construed as a reactor. Additionally, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a reactor in order to vary the temperature and pressure of the composition.

Regarding Claim 6, Tillotson teaches that this process uses a sol-gel process (abstract).

Regarding Claim 7, Tillotson teaches that crystals (para. 0022) or crystallites grow in this process (para. 0060).

Regarding Claim 9, Tillotson explains that the products used to make the metal oxides have little to no structure (Fig. 1, beaker with the sol a colloid solution).

Regarding Claim 11, Tillotson describes that the metal pre-cursor is a mixture of compounds that are in several different phases (Fig. 1, 4 beakers that demonstrate the various phases the solutions are in).

Regarding Claim 17, Tillotson teaches that water, methanol, ethanol, and other alcohols can be in the compound mixture (para. 0037 and Claim 8).

Regarding Claim 18, Tillotson describes the metal or metal alkoxide precursor to comprise any of the elements in the periodic table in groups 2-13, which would include Boron.

Regarding Claim 25, Tilloston teaches that the gelation process can be conducted at ambient temperature and drying at low temperature, which would fall within the range of between 50-400 degrees Celsius (para. 0017).

Regarding Claim 30, Reverchon teaches operating the process as described in the rejection to Claim 1 at a pressure of 10MPa (Introduction) and a temperature of between 258 to 295 degrees Celsius (Introduction). Reverchon also teaches a higher pressure (Pg. 254, col. 1, para. 2, 30MPa), a lower temperature (pg. 254, col. 1, para. 2, 50 degrees Celsius). It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the pressure and temperature of the reaction according to the desired product.

Regarding Claim 32, Reverchon teaches operating the process as described in the rejection to Claim 1 at a pressure of 10MPa (Introduction) and a temperature of between 258 to 295 degrees Celsius (Introduction). Reverchon also teaches a higher pressure (Pg. 254, col. 1, para. 2, 30MPa), a lower temperature (pg. 254, col. 1, para. 2, 50 degrees Celsius). It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the pressure and temperature of the reaction according to the desired product.

Regarding Claim 39, Tillston teaches that the fuel added to the mixture can be a particulate metal (para. 0058), which is an additional metal added to the metal alkoxide.

Regarding Claim 43, Tillotson teaches that the metal-containing precursor can be a metal alkoxide (Claim 1).

Regarding Claim 51, Tillotson teaches that water, methanol, ethanol, and other alcohols can be in the compound mixture (para. 0037 and Claim 8).

Regarding Claim 52, Tillotson explains that other solvents may be used in addition to water (para. 0037).

Regarding Claim 92, Tillotson explains that a long list of possible compounds can be used in the mixture, including trimethylene oxide (para. 0032).

Regarding Claim 93, Tillotson describes use of an oxide material (para. 0032) that serves as the matrix for the seed formation. This matrix can be construed as the collecting agent.

Regarding Claim 97, Tillotson teaches formation of a metal-oxide oxidizer skeletal structure whereby fuel is added to the matrix (para. 0068). Since this solid matrix forms, it would have been obvious to one of ordinary skill in the art at the time of the invention that it would be separable from the crystallites formed within the spaces in the structure and reusable as filling material.

Regarding Claim 98, Tillotson explains that the compound can be separable using a super-critical extraction or non-supercritical extraction of the liquid phase, such as with low temperature evaporation (para. 0068).

Regarding Claim 103, Tillotson instructs on a method of making a metal oxide material using a modified sol-gel process (abstract and para. 0026). In one process, Tillotson teaches using a metal salt reduction process route (para. 0032), a metal alkoxide precursor route (para. 0034), or the process whereby other solvents are used with water (para. 0037). According to Tillotson, one method of making the metal oxide is to dissolve a metal salt or metal alkoxide in a solvent to form a metal salt solution or a metal alkoxide solution (claim 1). Tillotson teaches that one can optionally add a proton scavenger to the solution (claim 1), which can be a hydrocarbon-based compound or an alcohol (para. 0032). Afterwards, a fuel source is added to the mixture (Claim 1), such as a particulate metal (para. 0058). This composition can also comprise polymers (para. 0063). Since the metal salt or metal alkoxide is in a solvent, it is therefore also in contact with the solvent. This mixture is then followed by a supercritical extraction (claim 5) wherein the compound can be carbon dioxide (para. 0020). Furthermore, this reaction is made in a series of beakers which can be construed as a reactor. Additionally, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a reactor in order to vary the temperature and pressure of the composition.

Finally, Tillotson teaches that the size of the product is generally smaller than 20nm (para. 0021).

Claims 1, 112 and 114 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lauf (6600645).

Lauf teaches a method of fabricating small, dense beads of metal oxide materials (abstract) using a process that is further made enabled by a specific apparatus (Fig. 2). Lauf teaches that this process involves using a metal precursor (such as titanium tetrachloride, col. 8, line 6), mixed with titanium (col. 8, line 13), water (col. 8, line 14), a HMTA/urea solution (col. 8, lines 14-15) and then processed. Other solutions such as Ba(OH)₂ could be used (col. 8, line 48). The beads have a certain particle size (col. 3, line 34, 41-43). Lauf further explains that all these starting materials are injected into the apparatus (col. 6, lines 33-35) in the form of a "chilled apparatus broth pot". The chambers subsequent to this injection can be considered the reaction chambers.

Regarding Claim 114, Lauf teaches a method of fabricating small, dense beads of metal oxide materials (abstract) using a process that is further made enabled by a specific apparatus (Fig. 2). Lauf teaches that this process involves using a metal precursor (such as titanium tetrachloride, col. 8, line 6), mixed with titanium (col. 8, line 13), water (col. 8, line 14), a HMTA/urea solution (col. 8, lines 14-15) and then processed. Other solutions such as Ba(OH)₂ could be used (col. 8, line 48). The beads have a certain particle size (col. 3, line 34, 41-43). Lauf further explains that all

these starting materials are injected into the apparatus (col. 6, lines 33-35) in the form of a "chilled apparatus broth pot". The chambers subsequent to this injection can be considered the reaction chambers. Since the solvent and the metal-containing product are mixed together, it is obvious that they would come into contact with each other.

Claims 13, 15, 24, 29 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tillotson as applied to claim 1 above, and further in view of Lauf (6600645).

Lauf teaches a method of fabricating small, dense beads of metal oxide materials (abstract) using a process that is further made enabled by a specific apparatus (Fig. 2). Lauf teaches that this process involves using a metal precursor (such as titanium tetrachloride, col. 8, line 6), mixed with titanium (col. 8, line 13), water (col. 8, line 14), a HMTA/urea solution (col. 8, lines 14-15) and then processed. Other solutions such as $\text{Ba}(\text{OH})_2$ could be used (col. 8, line 48). The beads have a certain particle size (col. 3, line 34, 41-43). Lauf further explains that all these starting materials are injected into the apparatus (col. 6, lines 33-35) in the form of a "chilled apparatus broth pot". The chambers subsequent to this injection can be considered the reaction chambers. Lauf does not teach that there is any particular order in this process.

Regarding Claim 15, Lauf explains that the ingredients described above are mixed prior to introducing them into the reactor (col. 8, lines 46-48).

Regarding Claim 24, Lauf teaches use of a reactor (col. 8, line 47), but does not specify the temperature it is operated at. It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the temperature based on the desired product since the reactor has a general operating temperature range.

Regarding Claim 29, Lauf teaches operating the reaction at an elevated pressure (abstract and col. 8, lines 51). Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the pressured based on the desired produce since the reactor has a general operating pressure range.

Regarding Claim 39, Lauf explains adding a plurality of ingredients, including a semi-metal into a reactor (col. 8, line 45-47).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHENG HAN whose telephone number is (571)270-5823. The examiner can normally be reached on Monday-Thursday, 8:00-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

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Sheng Han
Examiner
Art Unit 1793

SH
April 30, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793